REMARKS

Election/Restriction Requirement:

The Examiner restricted the claims into two inventions under 35 U.S.C. § 121.

I. Claims 1 - 10, drawn to an apparatus classified in class 118, subclass 715.

II. Claims 11 - 25, drawn to a method, classified in class 427, subclass 248.1.

Applicants elected to prosecute Claims 1 - 10 in the present application and to file a separate divisional application with respect to Claims 11 - 25. Claims 11 - 25 have been cancelled herein.

Amendment of the Claims:

Due to the narrowing of the scope of Claim 1 to "consists essentially of" by the amendment requested herein, a new Claim 26 has been added to include the use of a remote plasma source which may be used in combination with the processing chamber and the coating precursor and catalyst gas handling systems which are recited in Claim 1. The remote plasma source is shown in Figure 1 as 110, and is described in the application Specification at paragraph [0037] Page 13, lines 12 - 18.

Claim Rejections Under 35 U.S.C. §112:

Claims 1 - 10 stand rejected under 35 U.S.C. § 112, second paragraph, as being indefinite on grounds that Claim 1 includes limitations such that the number of different devices which are present in the apparatus is said to be unclear. In addition, Claim 1 is said to recite the limitation "the first process controller" without sufficient antecedent basis.

The language of Claims 1 - 10 has been amended to clarify the relationship between the various elements of the apparatus, as they are illustrated in Figure 1, and as they are described in applicant's Specification in general. If the Examiner would like to make any suggestions after reading the amended claim language, applicants' attorney would like to have the opportunity to take advantage of the Examiner's suggestions to further clarify the claims, if necessary.

Claim Rejections Under 35 U.S.C. §102:

Claims 1, 2, 9/1, 9/2, and 10 are rejected under 35 U.S.C. § 102(b) as being anticipated by Hatano, U.S. Patent 5,989,345.

Claim 1 is an independent apparatus claim, from which Claims 2 and 9/1 depend and from which Claims 9/2 and 10 depend indirectly. Applicants contend that their invention as claimed in Claims 1, 2, 9/1, 9/2, and 10 is not anticipated by the Hatano '345 patent.

The subject matter disclosed in the Hatano reference is a process gas supply apparatus for supplying process gas to a substrate processing chamber, and in particular for formation of a Ti, or TiN, or TiSi film on a tungsten substrate during the formation of semiconductor devices. The process gas, $TiCl_4$ in particular, is mixed with a carrier gas prior to entry into the substrate processing chamber. The carrier gas is used to "guide" the process gas into the substrate processing chamber. The process gas supply apparatus is far more complicated than applicants' apparatus. Applicants' invention is focused on an apparatus and method which enable the use of coating/thin film-forming precursor materials which have a very low vapor pressure. These materials are a liquid or a solid at room temperature and are difficult to handle without condensation on surfaces they contact. Applicants' Claim 1 includes the recitation that at least one coating precursor used for formation of the coating exhibits a vapor pressure below about

150 Torr at a temperature of 25 °C. While this is a functional limitation and is not a part of the apparatus, it is directly tied to the ability of the apparatus to perform as required. The elements recited in applicants' apparatus of Claim 1 are capable of being used in combination with such a coating precursor without problems which are encountered by complicated multiple valving and carrier gas flow systems of the kind described in the Hatano reference.

Applicants' apparatus is used to deposit thin layers/coatings where at least one coating precursor, and in some instances a catalyst in addition to a coating precursor, is transferred to the substrate processing chamber in a manner such that the vaporous coating precursor and the vaporous catalyst, if present, each remain unaltered during the transfer to the substrate processing chamber. There is no carrier gas mixed with the coating precursor or a catalyst. As a result of not using a carrier gas, the system for delivery of the coating precursor, and catalyst if used, is much simpler. Further, there is no carrier gas to contaminate, dilute, or interfere with the coating formation reaction taking place at the substrate surface.

The Hatano process gas delivery system makes use of a carrier gas in all embodiments. As a result, there are necessary piping and complex valving systems which connect a "gas storing section" to a carrier gas introducing pipe, and additional valving with at least one open/shut valve. In addition, the controlling section for the process gas supply apparatus of Hatano also includes a communication state between the carrier gas introducing pipe and the gas storing section and requires a "switchover" of the open/shut valves attached to the process gas filling circuit and the process gas releasing circuit.

In view of the difference in the number of elements required in the apparatus and the difference in functionality of the apparatus described in the Hatano reference from the apparatus

of the present invention, the Examiner has failed to provide a prima facie case of anticipation. The Examiner is respectfully requested to withdraw the rejection of Claims 1, 2, 9/1, 9/2, and 10 under 35 U.S.C. § 102(b) as being anticipated by Hatano, U.S. Patent 5,989,345.

Claim Rejections Under 35 U.S.C. § 103:

Claims 2 - 8, 9/4 and 9/5 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Hatano, U.S. Patent 5,989,345.

All of these claims depend either directly or indirectly from Claim 1. Applicant contends that these claims as amended are not obvious in view of the Hatano reference.

The Hatano reference teaches away from the present invention by teaching the need to use a carrier gas in combination with the processing gas which is used in the Hatano system. As discussed above, the use of a carrier gas is far more complicated and involves the use of considerable additional apparatus elements. Further, at the reaction surface of the substrate, the reactants are diluted and influenced by the carrier gas. Applicants' apparatus provides undiluted, uncontaminated coating precursor gases at the surface of the substrate. The Hatano disclosure teaches away from the current invention by teaching that the use of a complicated valving system is required to provide a carrier gas which "guides" the process gas to the process chamber. The Hatano reference does not even suggest that a carrier gas need not be used, and that a more streamlined apparatus may be used. The Hatano disclosure does not enable applicant's invention and does not render applicant's invention obvious.

With respect to Claim 4, the Hatano reference does not discuss the use of a catalyst to obtain the reaction of process gases which are used to form the coating or thin layer on the substrate surface, and therefore does not describe the apparatus to be used for this function.

In view of the above distinctions, the Examiner has not provided a prima facie case of obviousness with respect to Claims 2 - 8, 9/4 and 9/4. The Examiner is respectfully requested to withdraw the rejection of Claims 2 - 8, 9/4 and 9/5 under 35 U.S.C. § 103(a) as being unpatentable over Hatano.

Claims 1 - 10 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Sneth et al., U.S. Patent 6,503,330, in view of Hatano, U.S. Patent 5,989,345.

The distinctions between the present invention as claimed in applicants' currently amended claims and the Hatano reference are discussed above.

The Sneth et al. reference pertains to an apparatus and method for depositing atomic layer deposition films in a manner which improves the continuity of the depositing film upon the surface of the substrate. (Title and Abstract) The Sneth et al. apparatus is shown in Figure 11. At Col. 10, lines 15 - 17, Sneth et al teaches that a thin film layer is deposited in a processing chamber 31. Processing gases enter the processing chamber through a gas distributor 35 located at one end of the processing chamber while a vacuum pump 36 and a throttling valve 37 which are located at the other end of the chamber draw and regulate gas flow across the wafer surface. To provide for this constant flow of gas across the wafer surface, Sneth et al. makes use of a carrier gas which is fed into an inlet in a mixing manifold 38, which is used to mix the various processing gases. The mixed carrier gas and processing gases are directed to a plasma forming

zone 39 for forming a plasma. The plasma which is formed is then fed into the gas distributor 35 and then into the chamber 31. This teaches away from applicants' apparatus which enables charging of individual coating precursors to the process chamber in unaltered form, without mixing with a carrier gas, without premixing of coating precursors prior to charging to the substrate coating chamber, and without converting the precursors into a plasma prior to charging the precursors to the substrate coating chamber.

Applicants' apparatus does not include a mixing manifold 38, and does not provide for the mixing of precursor materials or conversion of the mixture into a plasma prior to charging of the plasma to the substrate coating chamber. One skilled in the art will recognize that this difference in processing of materials prior to charging of materials to the processing chamber affects the coating produced to an extent that it totally changes the performance of the coating produced. The introduction and background art in the Sneth et al. reference describes the kinds of affects on the coating which occur using different charging schemes for reactant materials, for example.

The apparatus described by Sneth et al. is completely different from the apparatus described and claimed by applicants, because the method of coating deposition is completely different. There is no suggestion of applicants' apparatus in the Sneth et al. disclosure.

Both the Hatano reference and the Sneth et al. reference make use of layer deposition methods which require the use of a carrier gas. As a result, both of these references require a large number of coordinated and controlled apparatus elements which are not present in applicants' apparatus. Applicants' claims have been amended to make it clear that complex switching valve systems, mixing manifolds, and in-line plasma creation from process gas sources

of the kind illustrated in the Hatano and Sneth et al. references, respectively, are not present in applicant's apparatus which is used for a more carefully controlled application of reactive vapors to produce thin films and coatings on a substrate. There is no suggestion in applicants' description that the complicated apparatus illustrated in the Hatano and Sneth et al. references is required to carry out applicants' coating deposition method. A review of the apparatus shown in applicants' Figure 1 and the accompanying description makes it clear that applicants' intent is a minimalist approach which delivers carefully measured and controlled amounts of at least one coating precursor to a process chamber without altering the composition of the coating precursor prior to its entry into the processing chamber.

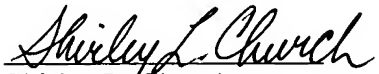
Applicants' exhaust port 112 from the process chamber 102 is used for the removal of reaction byproducts after a coating deposition in the process chamber, as described in Paragraph [0037], Page 13, lines 20 and 21 of applicant's Specification. Applicants' exhaust port is not used to permit a constant flow of carrier gas (or reactive gas) through the processing chamber, during deposition of a coating, as is the case in the Hatano and Sneth et al. references, which require additional manifolding and apparatus to control a constant flow of carrier gas through the processing chamber. One skilled in the art reading the teachings in the Hatano and Sneth et al. references would not contemplate the apparatus disclosed and claimed by applicant, which would not be capable of carrying out the coating deposition processes described in these references.

I view of the above distinctions, the Examiner has not made a prima facie case of obviousness. The Examiner is respectfully requested to withdraw the rejection of Claims 1 - 10 under 35 U.S.C. § 103(a) as being unpatentable over Sneth et al., in view of Hatano.

Applicants contend that amended Claims 1 - 10 and new Claim 26 are currently allowable, and the Examiner is respectfully requested to enter the amendments requested herein and to pass the application to allowance.

In the event that the Examiner would like to ask any questions or make suggestions with respect to the application, the Examiner is invited to contact applicants' attorney at the telephone number provided below.

Respectfully Submitted,



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